ORAL CONTRIBUTIONS

# 816 Diabetes Mellitus: What Can We Learn From Nuclear Studies?

Monday, March 08, 2004, 2:00 p.m.-3:30 p.m.
Morial Convention Center, La Nouvelle Orleans C

2:00 p.m.

## 816-1 Screening Stress Myocardial Perfusion Imaging for Risk Stratification in Asymptomatic Diabetic Men

Brian G. Abbott, James A. Arrighi, Yale University School of Medicine, New Haven, CT, VA Connecticut Healthcare System, West Haven, CT

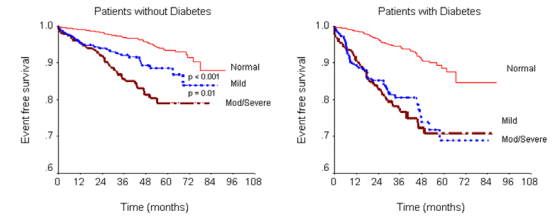
***Background***: The utility of screening asymptomatic diabetic patients for coronary artery disease (CAD) has not been defined. The objective of the current study was to evaluate the impact of a strategy employing screening stress myocardial perfusion imaging (MPI) on short-term prognosis in diabetic patients without symptoms or known CAD, who otherwise had no indication for stress MPI. ***Methods***: Asymptomatic diabetic males were enrolled in a strategy of screening stress MPI. All patients underwent routine MPI after exercise or dipyridamole stress using standard protocols, and were followed clinically for cardiac events (cardiac death, myocardial infarction, coronary angiography and revascularization). The Framingham global risk assessment score was used to for comparison of risk factors and to estimate the pre-test likelihood of CAD among patients. ***Results***: In 44 asymptomatic diabetic males (age 66±8 years) without known CAD, 20 (45%) had an abnormal stress MPI (9 mildly abnormal, 11 moderately/severely abnormal). During short-term follow-up (18±3 months), there were no major adverse cardiac events in 33 patients with a normal or mildly abnormal stress MPI. Of 11 patients with a moderately/severely abnormal MPI, 7 were subsequently referred for coronary angiography. All 7 had significant CAD (6 with left main coronary artery and/or 3-vessel CAD), and 5 of these patients required revascularization (4 surgical). The Framingham global risk profile score for CAD in patients with a normal/ mildly abnormal MPI was similar to those with a moderate/severely abnormal stress MPI (9.7±2.6 vs. 9.8±2.2, respectively, p=NS). ***Conclusion***: A strategy of screening asymptomatic diabetics for CAD with stress MPI may be justified for additional risk stratification beyond clinical assessment. Patients with a normal or mildly abnormal stress MPI have a favorable prognosis, while those with a moderately/severely abnormal study (25% in this population) have a high incidence of severe CAD that may warrant assessment with angiography.

2:15 p.m.

## 816-2 Risk Stratification of Diabetic Patients With Rest/Stress ECG-Gated Tc-99m Sestamibi SPECT Imaging: Significance of Mild Perfusion Abnormalities

Sachin M. Navare, Gavin L. Noble, Safi U. Ahmed, Alan W. Ahlberg, Deborah M. Katten, Lori L. Alexander, Leslee J. Shaw, William E. Boden, Gary V. Heller, Hartford Hospital, Hartford, CT

**Background**
Diabetic patients have a higher risk for future cardiac events than comparable non-diabetic patients. However, there are limited data comparing severity of perfusion abnormalities between diabetic and non-diabetic patients.
**Methods**
Consecutive patients referred for rest/stress Tc-99m sestamibi ECG-gated SPECT imaging were followed (29 ± 17 months) prospectively for cardiac events (cardiac death or myocardial infarction). Perfusion images were classified as normal [summed stress scores (SSS) = 0-2}], mildly abnormal [SSS = 3-5] and moderate/severely abnormal [SSS >5] by an 8-segment model. Of 8142 patients, 1865 were diabetics (23 %).
**Results**
Patients with diabetes had significantly higher annual cardiac event rates with both normal (2.6 % vs. 1.3 %, p<0.01) and abnormal (9.5 % vs. 4.9 %, p< 0.01) perfusion images as compared to patients without diabetes. In non-diabetic patients, cardiac event free survival correlated with the severity of perfusion abnormality. In diabetic patients, even mild perfusion abnormality was associated with significantly lower event free survival. However, assessment of LV function by gated-SPECT aided further risk stratification of this subgroup. Patients with mild defects and normal function had an intermediate prognosis while those with impaired function had worse prognosis.
**Conclusion**
Diabetic patients with mild perfusion abnormalities have a worse prognosis than non-diabetic patients. This may have implications for therapeutic approaches.

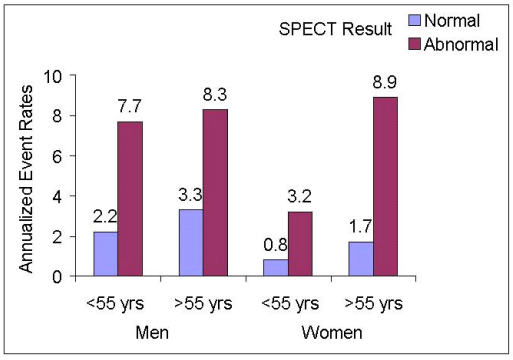



2:30 p.m.

## 816-3 Interaction of Age and Gender on Risk Stratification of Diabetic Patients With Rest/Stress ECG-Gated Tc-99m Sestamibi SPECT Imaging

Sachin M. Navare, Safi U. Ahmed, Gavin L. Noble, Alan W. Ahlberg, Deborah M. Katten, Giselle Cyr, Leslee J. Shaw, William E. Boden, Gary V. Heller, Hartford Hospital, Hartford, CT

**Background**
Diabetes is a powerful risk factor for CAD, particularly in women. However, there are limited data on the interaction of age, gender and diabetic status on risk stratification using myocardial perfusion imaging.
**Methods**
Consecutive patients referred for rest/stress Tc-99m sestamibi ECG-gated SPECT imaging were followed prospectively (29 ± 17 months) for cardiac events (cardiac death or myocardial infarction). Perfusion images were classified as normal [summed stress scores (SSS) < 3}] or abnormal [SSS ≥ 3] by an 8-segment model. Of 1865 diabetic patients, 884 (47%) were men and 981 (53%) were women.
**Results**
Annual cardiac event rates were significantly lower in women as compared with men (2.9 % vs. 4.8 %, p < 0.01). Cardiac event rates increased significantly with age (>55 years) in women (1.2 % vs. 3.6 %, p < 0.01), not in men (3.7 % vs. 5.2 %, p = ns). Risk stratification with perfusion imaging demonstrated that women > 55 years had outcomes similar to non-diabetic patients (p = ns). Normal perfusion in older women was associated with low risk (p = ns compared to younger women), while abnormal imaging was associated with the highest risk (comparable to diabetic men, p = ns). However, men with normal perfusion had intermediate risk, irrespective of age.
**Conclusion**
Increasing age has a significant impact on prognosis of diabetic women, but not men. Although the risk of cardiac events in older women increased significantly, myocardial perfusion imaging is effective in risk stratifying women diabetics.




2:45 p.m.

## 816-4 Effect of Glucose Lowering on Coronary Circulatory Dysfunction in Type 2 Diabetes Mellitus

Alvaro D. Facta, John O. Prior, Thomas H. Schindler, Jerson Cadenas, Manuel J. Quinones, Willa A. Hsueh, Heinrich R. Schelbert, David Geffen School of Medicine at UCLA, Los Angeles, CA

Objective: To determine the effect of plasma glucose lowering on coronary circulatory function in patients with type 2 diabetes.
Methods: In sixteen type 2 diabetic patients (age 55±6 years old) with elevated fasting glucose plasma levels myocardial blood flow (MBF) was measured with 13N-ammonia and PET at rest, during cold pressor testing (CPT) and during adenosine hyperemia; at baseline and after 12 weeks of glucose-lowering therapy with Glyburide and Metformin. MBF response to adenosine represented the total vasodilator capacity and to CPT the flow-mediated (endothelial-dependent) vasomotion.
Results: In eleven patients, plasma glucose decreased from 206±89 to 109±15 mg/dl (p<0.01) over the follow-up period (Group 1), while in 5 patients remain elevated 241±33 and 211±35 mg/dl (p=NS; Group 2).
In Group 2, MBF at rest was 0.69±0.19 ml/g/min at baseline and 0.65±0.22 ml/g/min during the follow up (p=NS). Adenosine hyperemic MBF was at baseline 1.38±0.11 ml/g/min and 1.64±0.37 ml/g/min at follow-up (p=NS). During CPT, the rate pressor product (RPP) increased by 38±12% at baseline and 36±11% at follow-up (p=NS), and MBF by only 15±22% and 22±10% at baseline and follow-up, respectively (p=NS).
In the Group 1 patients, MBF at rest was 0.78±0.24 ml/g/min at baseline and 0.67±0.12 ml/g/min at follow-up (p=NS) and these were similar to Group 2. Hyperemic MBF was 1.85±0.30 ml/g/min at baseline and did no increase significantly at follow-up, 2.05±0.51 ml/g/min (p=NS). Importantly, for RPP increases of 21±13 and 28±16% (p=NS) by CPT, the MBF significantly increased from 10±11% at baseline to 33±18% at follow-up (p<0.01). Moreover, the percent of improvement in the MBF response to CPT from baseline to follow-up was significantly correlated with the percent decrease in plasma glucose

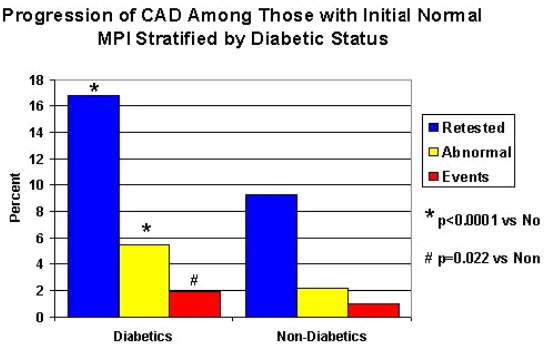
levels (r=0.57, p=0.06).
Conclusion: This finding suggests that glucose-lowering treatment in type 2 diabetes beneficially influences the coronary circulatory function. The significant increase of MBF responses to CPT may be related to the extent of lowered glucose plasma levels. This improvement may result directly from lowering plasma glucose levels and/or antidiabetic agents.

3:00 p.m.

816-5 **Progression of Coronary Artery Disesase in Diabetics Demonstrated by Single Isotope Rest/Stress Tc-99m Sestamibi Myocardial Perfusion Imaging: More Rapid Than Nondiabetics?**

Gavin L. Noble, Sachin M. Navare, Syed A. Hussain, Deborah M. Katten, Alan W. Ahlberg, Jacob Calvert, William E. Boden, Gary V. Heller, Hartford Hospital, Hartford, CT

**Background:** Patients with Diabetes Mellitus (DM) have increased cardiac risk compared to Non-Diabetics (Non-DM), even after normal myocardial perfusion imaging.
**Objective:** To evaluate the progression of CAD in diabetics with known or suspected CAD who received serial MPI.
**Methods:** The Hartford Hospital database was queried to obtain all patients with known or suspected CAD with Tc-99m rest/stress myocardial perfusion imaging studies from 1996-2001 (N=9581). DM and Non-DM were evaluated for patients undergoing repeat studies (DM =217, Non-DM=507), as well as the number converting from normal MPI to abnormal (fixed and reversible).
**Results:** Retesting occurred in 16.8% (217/1291) and 9.3% (517/5587) of DM and Non-DM with normal MPI (p<0.0001). Of those retested, 32.7% (71/217) of DM and 23.4% of Non-DM (121/517) converted from normal to abnormal (p<0.009). Of all with normal MPI, 5.5% of DM and 2.2% of Non-DM were sent for re-testing and converted to abnormal (p<0.0001, OR 2.63 {1.93,3.58}. 1.9% of DM and 1.0% of Non-DM (p=0.022, OR 1.80 {1.08, 2.97}) had cardiac death or non-fatal MI and were not included in the analysis of retesting. The cumulative cardiac death/MI/conversion rates were 7.4% and 3.2% for DM and Non-DM respectively (p<0.0001, OR 2.4{1.84,3.12}). Inter-test interval was 2.2 ± 1.3 years (p=ns)
**Conclusion:** CAD progresses more rapidly in patients with diabetes. Symptom based surveillance is able to identify patients at increased risk.




3:15 p.m.

816-6 **Prevalence of Silent Ischemia in Diabetic Patients With Subclinical Atherosclerosis: Detection by Stress Myocardial Perfusion Imaging**

Vijay D. Anand, Susan Fourie, David Hopkins, Patrick Sharp, Avijit Lahiri, Northwick Park Hospital, London, United Kingdom, Cardiac Imaging and Research Centre, Wellington Hospital, London, United Kingdom

**Background:** Patients with diabetes mellitus have accelerated atherosclerosis and increased cardiovascular morbidity and mortality. Hence the detection of significant coronary artery disease before the occurrence of coronary events is desirable in this patient group.We evaluated the prevalence of silent myocardial ischaemia in asymptomatic diabetic patients with moderate to severe subclinical atherosclerosis detected by Electron Beam Tomography (EBT).
**Methods:** We prospectively studied 275 asymptomatic patients with type 2 diabetes. 73 patients (26.5%)(mean age +/-SD: 57 +/-7,80% men) with moderate atherosclerotic plaque burden (coronary calcium score[CCS] >100 Agatston units) were evaluated further by Tc99m sestamibi SPECT. We compared the prevalence of silent ischaemia in this group with a randomly selected control group of asymptomatic non-diabetic patients with similar cardiovascular risk factor profiles and CCS (n = 77).
**Results:** Diabetic patients with moderate plaque burden had a higher prevalence (40% vs 17%, chi square statistic = 4.78, p = 0.029) and extent of myocardial ischaemia(mean summed stress score [SSS] +/- SD in diabetics: 2.4 +/- 3.8 vs mean SSS in non diabetics: 1+/- 2.5, p = 0.04) in comparison to non-diabetics with the same CCS. The above differences were attenuated in patients with a higher plaque burden (CCS>400).

| Patient Category | Myocardial Perfusion Imaging (MPI) |
|---|---|

| | Abnormal MPI | Normal MPI |
|---|---|---|
| Non-diabetic (CCS: 100-400) | 10(17%) | 48(83%) |
| Diabetic (CCS: 100-400) | 14(40%) | 21(60%) |
| Non-diabetic (CCS>400) | 8(44%) | 10(56%) |
| Diabetic (CCS>400) | 25(66%) | 13(34%) |

**Conclusion:** A lower CCS threshold (CCS>100) may be used to identify asymptomatic diabetic patients who have silent myocardial ischaemia.

POSTER SESSION

## 1112 General Echocardiography: A Potpourri of New Applications

Monday, March 08, 2004, 3:00 p.m.-5:00 p.m.
Morial Convention Center, Hall G
Presentation Hour: 4:00 p.m.-5:00 p.m.

1112-141 **Determinants of Visual 2-D Echo Assessment of Left Ventricular Wall Motion: Comparison With Myocardial Thickening on Cardiac Magnetic Resonance Imaging**

Charles A. Nelson, Jane McCrohon, Stephen Rose, Thomas Marwick, University of Queensland, Brisbane, Australia

**Background**: left ventricular wall motion on 2d echo (2de) is usually scored visually. we sought to examine the determinants of visually assessed wall motion scoring on 2de by comparison with myocardial thickening quantified on MRI.
**Methods**: using a 16 segment model, we studied 287 segments in 30 patients aged 61+/-11 years (6 female), with ischaemic LV dysfunction (defined by at least 2 segments dysfunctional on 2de). 2de was performed in 5 views and wall motion scores (WMS) assigned: 1 (normal) 103 segments, 2 (hypokinetic) 93 segments, 3 (akinetic) 87 segments. MRI was used to measure end systolic wall thickness (ESWT), end diastolic wall thickness (EDWT) and percentage systolic wall thickening (SWT%) in the plane of the 2de and to assess WMS in the same planes visually. No patient had a clinical ischemic event between the tests.
**Results**: visual assessment of wall motion by 2de and MRI showed moderate agreement (kappa = 0.425). Resting 2de wall motion correlated significantly (p<0.01) with ESWT(-0.345), EDWT(-0.379) and SWT%(-0.334).
**Conclusion**: SWT% and ESWT decrease with increasing WMS. However, the distinction between hypo and akinesis appears to correlate better with ESWT than SWT% or EDWT.

| | 1 (normal) | 2 (hypokinetic) | 3 (akinetic) | p ANOVA | p (2 vs 3) |
|---|---|---|---|---|---|
| EDWT | 9.2±2.4 mm | 9.2±2.1 mm | 8.4±1.5 mm | <0.0001 | 0.07 |
| ESWT | 12.8±3.0 mm | 11.3±3.1 mm | 9.9±3.2 mm | <0.0001 | 0.003 |
| SWT % | 47±41 | 24±24 | 21±31 | <0.0001 | 0.481 |

1112-142 **Prediction of Right Ventricular Ejection Fraction From Doppler Tei Index**

Shiro Yoshifuku, Yutaka Otsuji, Koichi Kihara, Masanori Tsurugida, Satoshi Yoshino, Shinichi Minagoe, Chuwa Tei, Fujimoto-Hayasuzu Hospital, Miyakonojyo, Japan, Kagoshima University School of Medicine, Kagoshima, Japan

**Background:** Measurement of right ventricular (RV) ejection fraction (EF) is not necessarily feasible due to the complicated geometry. Tei index, defined as the sum of isovolumetric contraction and relaxation time (ICT and IRT) divided by ejection time, is a non-geometric measure of ventricular function, which can be applied to the RV. We hypothesized that RV Tei index has significant correlation with RV EF. Therefore, the purpose of this study was to evaluate the feasibility of RV Tei index to predict EF. **Methods:** RV Tei index by Doppler echocardiography as $(a\text{-}b)/b$, where $a$ is the interval between cessation and onset of tricuspid flow and $b$ is the pulmonary flow ejection time, and RV ejection fraction by TC - 99m cardiac pool scintigraphy (first pass method) were measured in 25 patients with clinically suspected RV dysfunction (19 with ischemic heart disease, 2 with biventricular dysfunction, 2 with interstitial pneumonia, and 2 with mitral stenosis). RV EF < 40% was defined as reduced RV EF. **Results:** 1) RV Tei index has good and significant relation with RV ejection fraction (R = -0.81, P < 0.0001). 2) Diagnosis of reduced RV EF by Tei index > 0.44 had the sensitivity, specificity, and accuracy of 88%, 94%, and 92%, respectively. **Conclusion:** RV Tei index enables simple and feasible prediction of RV ejection fraction.